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How clean energy and efficiency can replace coal for a reliable, modern electricity grid

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A B S T R A C T

Aging coal-fired power plants are retiring all over the country, presenting the U.S. with an exciting opportunity to lead a global transition to a clean energy economy. The move away from coal begs the question: What will replace it? Energy efficiency, renewable energy and electric grid modernization should play an important part in replacing retiring coal capacity, and thereby mitigate the rush to build new natural gas plants.

1. Introduction

The move away from coal raises an urgent question: what will replace it? And, by extension, what kind of generation will the United States move toward? This article argues that the shift from coal provides the nation with an historic opportunity to lead a global transition to a clean energy economy and to put more Americans to work in the energy efficiency and renewable technology sectors. Renewable energy and energy efficiency avoid many environmental and price volatility concerns associated with continued reliance on fossil fuels, and when they are paired with new demand response and grid planning efforts—such as transmission upgrades and distributed storage—they can be every bit as reliable as natural gas. The article outlines three major opportunities—energy efficiency, renewable energy, and electric grid modernization—that can replace retiring coal-fired power plants without recourse to new natural gas plants, and summarizes some of the many economic and environmental benefits these clean energy technologies can provide. The article then gives examples of specific clean energy opportunities for the Pennsylvania-New Jersey-Maryland (PJM) Interconnection, the Midwest Interconnection System Operator (MISO), and the Southeast, the three electricity grid regions where the majority of U.S. coal plant retirements are occurring.

2. Energy efficiency is the most cost-effective available resource

The United States has massive untapped potential to save energy and money through more efficient appliances, buildings, lighting, and more—delivering the same quality services with less electricity consumption and spending.[1] Saving electricity is proven to be the most cost-effective way to meet our energy needs (although, as noted below, wind and solar energy are also rapidly emerging as a more cost-effective alternative to fossil-fueled generation in some areas).[2] By requiring electric utilities to implement programs that remove market barriers preventing individuals and businesses from choosing the most efficient option, states can cut energy demand and avoid the need for big investments in natural gas power plants and transmission infrastructure.[3] Regional transmission organizations (RTOs) like the PJM Interconnection and the Midcontinent Independent System Operator (MISO) can also operate such programs.

To understand how large the potential to save electricity is, consider energy efficiency programs in leading states like Rhode Island and Massachusetts. These two states have cost-effectively achieved electricity savings close to or over 3% of sales. In other words, the total energy savings of the devices and projects utilities put in place will, in their first year of operation, save around or more than 3% of electricity sales. These efficiency leaders achieved 3.27% and 2.85% energy savings in 2015, respectively, and have been consistently achieving high savings rates for the past few years.[4] In comparison, 20 states have yet

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[1] While the discussion focuses on savings opportunities in the electric sector, it is worth noting that energy efficiency programs can also target natural gas use in the residential, commercial, and industrial sectors. Several states have both electricity and natural gas efficiency programs.

[2] American Council for an Energy Efficient Economy New (ACEEE) Report Finds Energy Efficiency Is America's Cheapest Energy Resource Mar ch 2014 Lazard, Levelized Cost of Energy Analysis—Version 9.0, November 2015; Sheryl Carter, Scaling Up Energy Efficiency: Saving Money, Creating Jobs, and Slashing Emissions, Natural Resources Defense Council (NRDC) March 2013

[3] NRDC, Doing More and Using Less: Regulatory Reforms for Electricity and Natural Gas Utilities Can Spur Energy Efficiency, January 2011.

[4] Savings calculated using EIA Form 861 Sales and Savings Data for 2015. See EIA (2016). Electric power sales, revenue, and energy efficiency Form EIA-861 detailed data files.

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to exceed annual efficiency savings of 0.6% of electricity sales.[5]

Promoting energy efficiency is the best way to keep electricity bills low for all consumers.[6] Energy efficiency directly reduces bills by reducing electricity consumption. It also suppresses wholesale electricity and capacity prices by minimizing total energy demand during peak times (e.g., a hot summer afternoon). This reduces the need to dispatch the generators with the highest operating costs, lowering the market price of electricity for all customers.[7] And importantly, by targeting low-income households, states can take steps to ensure that these benefits are maximized for those already facing the greatest energy burden.[8]

States that are just coming around to the benefits of this untapped resource can follow the lead of efficiency trailblazers like Rhode Island and Massachusetts because the regulatory framework that drives the significant energy savings in high-performing states is not state-specific. For example, smart regulatory policies in both Rhode Island and Massachusetts include adopting mechanisms that remove the disincentive for utilities to invest in any measures that would reduce their electricity sales. For instance, one approach is to include timely recovery of lost revenues through revenue decoupling—i.e., removing the disincentive for utilities to support energy-savings programs and ensuring that utilities recover authorized costs of service regardless of fluctuations in sales. Another approach is to grant timely cost recovery through customer rates—i.e., allowing utilities to recover their costs of delivering energy efficiency programs.[9] Utilities in these pioneering states also invest in well-designed programs that, among other things, offer rebates on the purchase price of energy-efficient appliances and equipment and work with retailers and distributors to make sure that customers know about efficient options and have access to them. The biggest utility programs help residential and commercial customers install efficient LED lighting by working with retailers, electrical contractors, and lighting designers to make these already cost-effective options even more attractive to consumers.[10]

Requiring that utilities invest in cost-effective energy efficiency programs has also been shown to unlock significant savings opportunities. For instance, Rhode Island invests a greater proportion of utility revenues in energy efficiency than any other state, primarily because instead of imposing arbitrary limits on monetary investment in efficiency programs or eligible customers, it requires that utilities invest in all cost-effective energy efficiency (energy efficiency that costs less, averaged over its lifetime, than the generation it replaces or avoids). Massachusetts does the same. In both states, electric utilities must save energy whenever it costs less than building new power plants or other costly infrastructure.[11]

In addition to the all-cost-effective mandate, Rhode Island and Massachusetts also do not allow large customers to opt out of contributing to the cost of energy efficiency programs, a practice that hinders savings in other states. Rather, they ensure that the programs include well-designed industrial opportunities that are tailored to deliver real cost savings to that very sector.[12] States that are still achieving low levels of savings should follow these best practices by adopting strong state energy savings goals and providing adequate funding to achieve them, designing programs based on the successful initiatives in leader states and their own, state-specific environments. The good news is that studies are showing that states with more recent energy efficiency legislation and regulatory activity have been able to quickly make up ground and are achieving savings comparable to states with much more mature efficiency regulatory programs.[13] For example, Arizona began expanding its energy efficiency programs only a decade ago, in contrast to states like California, Iowa, Massachusetts, Minnesota, and Wisconsin, which have had large-scale efficiency programs in place since the 1980s. Yet in 2013 Arizona became the state with the fourth-highest annual electricity savings in the country, with savings reaching an impressive 1.74% of retail sales from roughly 0.2% in 2006, according to ACEEE.[14] All states, regardless of historical performance, could boost programs to save energy and help achieve state and national climate and clean energy goals.

While much progress has been made on efficiency investments, large and cost-effective opportunities to reduce energy demand still exist against a backdrop of increasing coal plant retirements. In fact, various analyses have found that by 2050, cost-effective energy efficiency opportunities can collectively reduce energy use by 40 to 60% relative to the EIA 2015 demand forecasts.[15] Energy efficiency is already the most cost-effective and smart investment states can make to meet electricity demand, and its potential will become even greater as new energy saving technologies penetrate the market. For instance, the widespread commercial deployment of LED lighting technology for troffer light fixtures—the most common type of fixture in commercial and institutional buildings—could by itself generate 2.2% savings in national electricity use over the next decade.[16] Many regions are already incorporating efficiency into long-term resource planning. For example, the resource planning modeling for the new Northwest Power Plan for Idaho, Montana, Oregon, and Washington uses energy efficiency and demand response to fulfill nearly all projected growth in energy and capacity needs through 2035, even as the region retires coal capacity due to market forces, age, and regulations.[17] Energy efficiency is also a low-cost way to maintain regional reliability.[18] In fact, both ISO-New England—the Independent System Operator for New England and PJM have evaluated the reliability of energy efficiency programs to reduce demand. ISO-New England found that energy efficiency providers delivered significantly more peak demand savings than they had originally committed, and both ISO-New England and PJM concluded that energy efficiency has been the most reliable of all of the resource types that have committed to supply capacity in recent years.[19]

[5] E.I.A. 2016 Electric power sales, revenue and energy efficiency Form EIA-861 detailed data files

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[7] A Texas study that found that voluntary AC cycling programs would have saved $200 million over just the summer of 2011, and $85 million alone on the peak day of the summer. South-Central Partnership for Energy Efficiency as a Resource (2015). Incremental Demand Response Study: ERCOT Case Study.

[8] Ariel Drehobl and Lauren Ross, Lifting the High Energy Burden in America's Largest Cities, 2016

[9] Devra Wang et al., Doing More and Using Less: Regulatory Reforms for Electricity and Natural Gas Utilities Can Spur Energy Efficiency, NRDC, January 2011, https://www.nrdc.org/sites/default/files/doingmoreusingless.pdf.

[10] Katherine Tweed A Boom in Utility Rebates Drives LED Lighting, GreenTech Media, September 2012, https://www.greentechmedia.com/articles/read/A-Boom-inUtility-Rebates-Drives-LED-Lighting.

[11] ACEEE's State and Local Policy Database for more details on individual state EERS policies.

[12] Williams, Samantha, et al (2015). Stemming the Tide of Industrial Opt-Outs. ACEEE Summer Study on Energy Efficiency in Industry.

[13] Robert Neumann et al., Regulatory Update: A Twenty-State Review of Regulatory Regimes and Effective Energy Efficiency Programs Navigant Consulting 2016

[14] ACEEE, The 2013 State Energy Efficiency Scorecard.

[15] Steven Nadel, Neal Elliott, and Therese Langer, Energy Efficiency in the United States: 35 Years and Counting, ACEEE, June 2015; Paul J. Hibbard, Katherine A. Franklin, and Andrea M. Okie, The Economic Potential of Energy Efficiency: A Resource Potentially Unlocked by the Clean Power Plan, Analysis Group, Inc., December 2014.

[16] Chris Neme and Jim Grevatt, The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years, RAP and Energy Futures Group, February 2016.

[17] Northwest Power and Conservation Council, Seventh Northwest Conservation and Electric Power Plan, February 2016.

[18] Monitoring Analytics, Analysis of the 2019/2020 RPM Base Residual Auction, August 2016.

[19] Regulatory Assistance Project, Energy Efficiency Participation in Electricity Capacity Markets: The U.S. Experience Montpelier, VT: The Regulatory Assistance Project, September 2014.